

Application No. 09/990,849

2

**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

- 1 1. (currently amended) An imaging system for imaging a sample of interest  
2 comprising:  
3 an emitter enabled to project imaging radiation through said  
4 sample of interest, at least one of said emitter and said sample of interest  
5 being manipulable such that relative movement between said imaging  
6 radiation and said sample of interest is enabled; [[and]]  
7 a plurality of detecting modules disposed in a sparsely  
8 distributed configuration, including a first detecting module that is spaced  
9 apart from a neighboring second detecting module, said first and second  
10 detecting modules each having an array of sensors that are responsive to  
11 said imaging radiation, said detecting modules being cooperatively aligned  
12 with said emitter such that multiple said detecting modules are simultaneously  
13 irradiated by a continuous pattern of said imaging radiation, said detecting  
14 modules being cooperative with said emitter and said sample of interest for  
15 detecting regions of said sample of interest to generate series of sub-images  
16 during said relative movement between said imaging radiation and said  
17 sample of interest[[.]] said detecting modules being controlled such that each  
18 said detecting module provides a succession of sub-images in which at least  
19 some of said sub-images in said succession overlap with respect to imaging  
20 common portions of said sample of interest; and  
21 an integrating unit coupled to said detecting modules for  
22 computationally combining said sub-images on a basis of data that includes  
23 (a) angular data indicative of projection angles of said imaging radiation  
24 during said imaging of said common portions of said sample of interest and  
25 (b) positional data indicative of relative positions of said imaging radiation and  
26 said sample of interest in acquiring individual said sub-images.

Application No. 09/990,849

3

1 2. (currently amended) The imaging system of claim 1 wherein said first  
2 detecting module and said neighboring second detecting module are coupled  
3 to ~~[[an]]~~ said integrating unit by respective first and second channels, said first  
4 channel being independent from said second channel, said integrating unit  
5 including processing circuitry for integrating said sub-images to form a  
6 composite image of said sample of interest.

1 3. (currently amended) The imaging system of claim 2 wherein said  
2 ~~composite image includes one of~~ integrating unit is enabled to generate a  
3 three-dimensional image of said sample of interest. ~~and a two-dimensional~~  
4 ~~slice of said three-dimensional image.~~

1 4. (currently amended) The imaging system of claim 1 wherein said  
2 detecting modules each include a substrate having a physically discrete array  
3 of sensors, said substrates being individually connected to a supporting  
4 structure.

1 5. (cancelled)

1 6. (cancelled)

1 7. (cancelled)

1 8. (original) The imaging system of claim 1 wherein said emitter is an x-ray  
2 tube for projecting x-ray radiation, said emitter and said detecting module  
3 being on opposite sides of said sample of interest.

Application No. 09/990,849

4

1 9. (original) An x-ray imager for generating an image of an object comprising:  
2 an x-ray source for projecting a pulse of x-ray radiation through  
3 said object, said pulse being projected from a continuous region of said  
4 source; and  
5 a plurality of discrete sensor arrays, each said sensor array  
6 including a substrate having a two-dimensional pattern of sensor elements,  
7 at least some of said sensor arrays being spaced apart from adjacent sensor  
8 arrays by a distance greater than one-quarter of a cross-sectional distance  
9 of said two-dimensional pattern while being sufficiently close to enable said  
10 pulse to simultaneously irradiate a plurality of said sensor arrays, said sensor  
11 arrays being arranged for detecting time series of sub-images of overlapping  
12 portions of said object, said sub-images in each said time series being  
13 distinguishable as a result of relative displacement of said object with respect  
14 to said x-ray radiation from said source.

1 10. (original) The x-ray imager of claim 9 wherein said distance is greater  
2 than one-half of said cross-sectional distance of said two-dimensional pattern,  
3 said sensor arrays being substantially identical.

1 11. (original) The x-ray imager of claim 9 wherein said distance is at least  
2 equal to said cross-sectional distance of said two-dimensional pattern, said  
3 sensor arrays being substantially identical.

1 12. (original) The x-ray imager of claim 9 wherein said substrate is mounted  
2 on a detector support assembly, said detector support assembly including a  
3 supporting substrate on which said sensor arrays are individually mounted.

1 13. (original) The x-ray imager of claim 9 further comprising a controller for  
2 sequencing said relative displacement to generate said time series of sub-  
3 images and an integrator for computationally combining said sub-images to  
4 form one of a three-dimensional image and a two-dimensional slice of said  
5 object.

Application No. 09/990,849

5

1 14. (original) The x-ray imager of claim 9 further comprising an assembly for  
2 providing said relative displacement such that manipulation of said object is in  
3 a first direction and manipulation of said x-ray radiation from said source is in  
4 a second direction, said first direction being substantially perpendicular to said  
5 second direction.

1 15. (original) The x-ray imager of claim 9 further comprising an assembly for  
2 providing said relative displacement at uniform velocity.

1 16. (original) The x-ray imager of claim 9 wherein said object is a printed  
2 circuit board (PCB).

1 17. (currently amended) A method of forming a composite image comprising  
2 the steps of:  
3 projecting timed pulses of x-ray radiation from a common source  
4 through a sample of interest;  
5 providing relative movement between projections of said x-ray  
6 radiation from said source and said sample of interest;  
7 exposing a sparsely distributed configuration of area detectors  
8 to said pulses after passage through said sample of interest, such that spaced  
9 apart regions of said sample of interest are imaged for each of said pulses;  
10 acquiring a plurality of sub-images corresponding to portions of  
11 said sample of interest during said relative movement by said area detectors,  
12 including associating individual said sub-images with axial direction informa-  
13 tion indicative of a projection angle of said x-ray radiation in acquiring said  
14 individual sub-images and including associating individual said sub-images  
15 with position information indicative of relative locations of said source in  
16 acquiring said individual sub-images; and  
17 processing said sub-images to form an image of said sample of  
18 interest, including utilizing said axial direction information and said position  
19 information in determining formation of said image.

Application No. 09/990,849

6

1 18. (original) The method of claim 17 wherein said step of acquiring includes  
2 collecting a sequence of sub-images corresponding to overlapping regions of  
3 said sample of interest by at least one of said area detectors during said  
4 relative movement, said step of processing including integrating said  
5 sequence of sub-images to generate said image.

1 19. (original) The method of claim 18 wherein said step of collecting includes  
2 projecting at least one pulse of said x-ray radiation onto said sample for  
3 each of said overlapping regions.

1 20. (cancelled)

1 21. (currently amended) The method of claim 17 wherein said step of  
2 processing said sub-images includes forming ~~one of~~ a three-dimensional  
3 image and a two-dimensional view of said ~~three-dimensional image~~ of said  
4 sample of interest.

1 22. (original) The method of claim 17 wherein said step of exposing said  
2 plurality of area detectors includes providing dedicated electrical connection  
3 between each of said area detectors and common processing circuitry so as  
4 to enable electrical isolation among said area detectors.

1 23. (original) The method of claim 18 wherein said step of integrating  
2 includes computationally combining said sequence of sub-images after at  
3 least one of:  
4 a. scaling,  
5 b. resampling to change magnification,  
6 c. offsetting spatially to match regions, and  
7 d. adjusting to reflect an absorption of said radiation by said sample of  
8 interest.

Application No. 09/990,849

7

- 1 24. (original) The method of claim 23 wherein said step of combining
- 2 includes algebraically adding said sub-images of said sequence.

- 1 25. (original) The method of claim 23 wherein said step of combining
- 2 includes one of unfiltered backprojecting and filtered backprojecting.

- 1 26. (original) The method of claim 23 wherein said step of combining
- 2 includes selecting said sub-images having minimum artifacts.